

School of Mathematics
and the Maxwell Institute
University of Edinburgh
James Clerk Maxwell Building
The King’s Buildings
Peter Guthrie Tait Road
Edinburgh
EH9 3FD
United Kingdom

Research Interests:

Partial differential equations; nonlinear, hyperbolic, and geometric PDE; general relativity; mathematical physics.

Education:

Ph.D. Rutgers University 2004
B.Sc. University of British Columbia 1999

Positions:

Lecturer (UK equivalent of Assistant Professor with tenure)	8/08 - present	University of Edinburgh
Junior Scientist	8/07 - 7/08	Geometric Analysis and Gravitation group, Albert Einstein Institute
Postdoctoral Fellow	8/06 - 8/07	University of Toronto
NSERC Postdoctoral Fellow	8/04 - 8/06	University of Toronto
Graduate Assistant	9/03 - 8/04	Rutgers University
Summer Session Instructor	6/03 - 7/03	Rutgers University
Teaching Assistant	9/01 - 6/03	Rutgers University
NSF VIGRE trainee	9/99 - 6/01	Rutgers University
Undergrad. Teaching Assistant	9/97 - 4/99	University of British Columbia

Grants

10/2017-10/2018 Edinburgh Mathematical Society (PI) and London Mathematical Society (CoI): Workshop series on hyperbolic PDE £900 + £1200.
01/2013-06/2015 EPSRC first grant (awarded 2/2012) The black hole stability problem, EP/J011142/1: £125,000.

Honours and Awards:

- 09/2013-12/2013 Research Member; Mathematical Relativity; Mathematical Sciences Research Institute (MSRI).
 09/2008-12/2008 Visitor; Geometry, Analysis, and General Relativity program; Mittag-Leffler Institute.
 2004-2006 NSERC Postdoctoral fellow .

Lecture series:

- 2011 Current progress on stability of black holes (10 lectures), Beijing International Centre for Mathematical Research, Beijing Summer Program in Mathematical Relativity

Talks:

- 2017 Geometric Transport Equations in General Relativity; Erwin Schrodinger Institute
 2017 8th Itinerant Meeting in PDEs; Basque Center for Applied Mathematics
 2016 Geometric PDEs Symposium; University of Warwick
 2016 Geometry and Analysis Seminar; Imperial College London
 2015 EquaDiff; Lyon 1 Université
 2015 Black Hole Stability Workshop; Fields Institute, Toronto
 2015 Analysis and PDE seminar; University of Sussex
 2015 Mathematical Problems in General Relativity; Simons Center for Gravitational Physics, Stony Brook
 2014 LMS Network Meeting on PDE and Harmonic Analysis; Univeristy of Warwick
 2014 Asymptotic Analysis in General Relativity; Univeristy of Grenoble
 2014 LMS workshop: Scattering Theory & Wave Equations; University of Loughborough
 2014 Second Scottish Partial Differential Equation Colloquium; International Centre for Mathematical Sciences, Edinburgh
 2014 Edinburgh Mathematical Physics Group; University of Edinburgh
 2014 Nonlinear Wave Equations and General Relativity Workshop; University of Oxford
 2013 Analysis/ PDE seminar; UC Berkeley
 2013 Introductory Workshop: Mathematical Relativity (2 lectures); Mathematical Sciences Research Insitute (MSRI), Berkeley
 2013 ANR “Analyse Asymptotique en Relativité Générale” first meeting; Université de Cergy-Pontoise
 2013 Analysis Seminar; University of Oxford
 2013 Conference on Nonlinear Wave Equations; Institut Henri Poincaré, Paris
 2013 Scottish Partial Differential Equation Colloquium; International Centre for Mathematical Sciences, Edinburgh
 2013 4th Itinerant Workshop on PDE’s; Sapienza University of Rome

- 2012 Internaional Congress on Mathematical Physics; Aalborg, Denmark
- 2012 Seminar on Mathematical Relativity; Université Pierre et Marie Curie
- 2012 British Applied Mathematics Colloquium; University College London
- 2011 Dynamics of General Relativity; Erwin Schrödinger Institute, Vienna
- 2011 Beijing Summer Program in Mathematical Relativity; Beijing International Centre for Mathematical Research
- 2011 JAMI; Johns Hopkins University
- 2011 Resonances and Scattering in General Relativity Workshop; Institut de Mathématiques de Bourgogne
- 2011 Seminar on Mathematical Relativity; Universit'e Pierre et Marie Curie
- 2010 Analysis seminar; Princeton University
- 2010 SIAM conference on nonlinear waves and coherent structures; Philadelphia
- 2010 Geometric analysis and general relativityum; Banff (BIRS)
- 2010 Center for Analysis and nonlinear PDEs, mid-project symposium; Edinburgh
- 2010 PDEs, relativity, and nonlinear waves; Granada
- 2010 Joint geometric analysis seminar; CIRM
- 2009 Analysis seminar; University of Glasgow
- 2009 Mathematical aspects of general relativity; Mathematisches Forschungsinstitut Oberwolfach
- 2009 Hot topics: black holes in relativity; MSRI
- 2009 Relativity seminar; University of Oxford
- 2009 Analysis seminar; University of Edinburgh
- 2008 Geometric Analysis and Partial Differential Equations seminar; University of Cambridge
- 2008 LMS Network in Harmonic Analysis and PDE workshop; Warwick University
- 2008 Geometry, Analysis, and General Relativity program; Mittag-Leffler institute
- 2008 Hyperbolic differential equations in general relativity; Mathematical Institute of Bordeaux (IMB)
- 2008 Open Classical and Quantum Dynamical Systems III conference; Université de Lille I
- 2007 Fachbeirat; Albert Einstein Institute
- 2007 Wave equation seminar (four talks); Albert Einstein Institute
- 2007 Geometric Analysis and Gravitation Seminar; Albert Einstein Institute
- 2007 ; Twelfth Canadian Conference on General Relativity and Relativistic Astrophysics
- 2007 Differential Equations Seminar; University of Michigan
- 2006 Winter 2006 Meeting; Canadian Mathematical Society
- 2006 Analysis seminar; University of San Diego
- 2005 Global Problems in Mathematical Relativity; Isaac Newton Institute, Cambridge University
- 2005 Nonlinear wave phenomena; Anogia Academic Village
- 2005 Eighth New Mexico Analysis Seminar; New Mexico State University
- 2005 Young Mathematicians' Conference in PDE and Dynamical Systems; McMaster University
- 2004 Applied Math/PDE/Analysis Seminar; University of Toronto

2003 Thematic Program on Partial Differential Equations; Fields Institute Seminar.

Service:

07/2017	External review panel member, Higgs Centre for Theoretical Physics
12/2016-present	Subject editor, Proceedings of the Edinburgh Mathematical Society
9/2012-present	School of Mathematics PhD admissions officer
3/2010-4/2014	Centre for analysis and nonlinear PDE minisymposium organiser
1/2010-5/2013	Scottish mathematical sciences training centre, management committee: student liaison officer
9/2011-	EPSRC Peer Reviewer
1/2010-9/2013:	Curriculum review committee member for years 1 (2010-11), 2 (2011-12), and 3 (2012-13)
9/2011	EPSRC, mathematics prioritisation panel
5/2010-9/10	Mathematical Relativity workshop local organiser
8/2010:	Interview committee member
9/2009-8/2010	me3/me4 course organiser
8/2009-8/2010	Colloquium organiser, University of Edinburgh
10/2009	Internal PhD examiner for Evgeni Ovcharov, University of Edinburgh
9/2007-9/2008	Co-organiser, Wave equation seminar, Albert Einstein Institute
9/2005-9/2007	Co-organiser, Applied Math/ PDE/ analysis seminar, University of Toronto
2000-2004	Graduate student mentor, Research Experience for Undergraduate program, Rutgers University

Supervision and examination

Post-doc supervisor	T. Bäckdahl (2013-2015)
Ph.D. supervisor	Z. Wyatt (2016-)
Ph.D. examiner	Sari Ghanem (Paris 7, 2014), Sarah Khwaja (Edinburgh, 2014), Tim Candy (Edinburgh, 2012), Evgeni Ovcharov (Edinburgh, 2009)

Classes taught:

- 1/2017-5/2017 Advanced PDE II: Hyperbolic PDE, (2 students) PhD level University of Edinburgh
- 1/2017-5/2017 Differentiable Manifolds, (14 students) Fourth-year mathematics undergraduate University of Edinburgh
- 9/2016-12/2016 Essentials in Analysis and Probability, (19 students) Measure theory for fourth-year undergraduates. University of Edinburgh
- 1/2016-5/2016 Advanced PDE II: Hyperbolic PDE, (5 students) PhD level University of Edinburgh
- 1/2016-5/2016 Differentiable Manifolds, (17 students) Fourth-year mathematics undergraduate University of Edinburgh
- 9/2015-12/2015 Essentials in Analysis and Probability, (18 students) Measure theory for fourth-year undergraduates. University of Edinburgh
- 1/2015-5/2015 Differentiable Manifolds, (16 students) as above University of Edinburgh
- 9/2014-12/2014 Essentials in Analysis and Probability, (20 students) As above. University of Edinburgh
- 1/2014-5/2014 Analysis of Nonlinear Waves, (2 students) MSc and fourth-year mathematics undergraduate. Created curriculum and materials. ODEs and Picard iteration, Noether's theorem, energy estimates, one-dimensional Sobolev estimates, local existence and uniqueness of solutions. University of Edinburgh
- 9/2012-12/2012 Analysis of Nonlinear Waves, (15 students) As above. University of Edinburgh
- 9/2012-12/2012 Pure and Applied Analysis (semester 1: pure analysis), (90 students) Third-year mathematics undergraduates. Sequences of functions, uniform continuity and convergence, Riemann integrability, Fourier series. University of Edinburgh
- 1/2012-5/2012 Analysis of Nonlinear Waves, (5 students) As above. University of Edinburgh
- 9/2011-12/2011 Pure and Applied Analysis (semester 1: pure analysis), (150 students) As Above. University of Edinburgh
- 1/2011-5/2011 Analysis of Nonlinear Waves, (13 students) As above. University of Edinburgh
- 9/2010-05/2011 Mathematical Communication and Computation, (100 students) Third-year mathematics undergraduates. Basic Maple, LaTeX, group presentations and projects, advanced Maple, individual presentations and projects. Individually taught, marked in coordination with others. University of Edinburgh
- 1/2009-5/2009 Mathematics for Elec/Mech Eng 4, (125 students) As below University of Edinburgh.
- 9/2009-12/2009 Applicable mathematics for physical sciences students 3, (150 students) Second-year physics students. Linear algebra to diagonalisation. Independently taught. University of Edinburgh.

- 1/2009-5/2009 Mathematics for Elec/Mech Eng 4, (125 students) Second-year engineering students. Several variable Calculus, covering functions of several variables, differentiation and integration, and Stokes's/ Green's/ Gauss's theorem. University of Edinburgh.
- 1/2007-5/2007 General Relativity, (12 undergraduates and 4 graduate students) Cross-listed fourth-year undergraduate and graduate course covering introductory differential geometry, Einstein's equations, and important solutions. Required for the mathematics specialist degree. Taught independently. University of Toronto.
- 9/2006-12/2006 Differential equations and linear algebra for engineers, (80 students) Second-year course covering ordinary differential equations, vector spaces, eigenvalues, and systems of linear differential equations. Part of a larger coordinated course. University of Toronto.
- 9/2005-5/2006 Vector Calculus, (120 students) Second year Calculus, covering functions of several variables, differentiation and integration, and Stokes's/ Green's/ Gauss's theorem. Part of a larger coordinated course. University of Toronto.
- 9/2004-5/2005 Calculus!, (50 students) First year Calculus, covering continuity, differentiation, integration, and power series. At an intermediate level of difficulty between an honour's class and a standard class. Part of a larger coordinated course. University of Toronto.
- 6/2003-7/2003 Calculus II, (30 students) Second semester Calculus, covering integration and power series. Taught independently. Rutgers University.

Bibliography

- [1] Lars Andersson, Thomas Bäckdahl, and Pieter Blue. A new tensorial conservation law for Maxwell fields on the Kerr background. *J. Differential Geom.*, 105(2):163–176, 2017. arXiv:1412.2960.
- [2] Lars Andersson, Pieter Blue, and Jinhua Wang. Morawetz estimate for linearized gravity in Schwarzschild. 2017. arXiv:1708.06943.
- [3] Lars Andersson, Thomas Bäckdahl, and Pieter Blue. Decay of solutions to the Maxwell equation on the Schwarzschild background. *Classical Quantum Gravity*, 33(8):085010, 20, 2016. arXiv:1412.2960.
- [4] Lars Andersson, Thomas Bäckdahl, and Pieter Blue. Geometry of black hole spacetimes. 2016. arXiv:1610.03540, survey paper.
- [5] Lars Andersson, Pieter Blue, and Jérémie Joudioux. Hidden symmetries and decay for the Vlasov equation on the Kerr spacetime. 2016. arXiv:1612.09304.
- [6] L. Andersson and P. Blue. Hidden symmetries and decay for the wave equation on the Kerr spacetime. *Annals of Mathematics*, 182(3):787–853, 2015. arXiv:0908.2265.
- [7] Lars Andersson, Thomas Bäckdahl, and Pieter Blue. Spin geometry and conservation laws in the Kerr spacetime. In *Surveys in differential geometry 2015. One hundred years of general relativity*, volume 20 of *Surv. Differ. Geom.*, pages 183–226. Int. Press, Boston, MA, 2015. arXiv:1501.04641, survey paper.
- [8] Lars Andersson and Pieter Blue. Uniform energy bound and asymptotics for the Maxwell field on a slowly rotating Kerr black hole exterior. *J. Hyperbolic Differ. Equ.*, 12(4):689–743, 2015. arXiv:1310.2664.
- [9] Lars Andersson, Thomas Bäckdahl, and Pieter Blue. Second order symmetry operators. *Classical Quantum Gravity*, 31(13):135015, 38, 2014. arXiv:1402.6252.
- [10] P. Blue. Symmetries and hidden symmetries for fields outside black holes. In *XVI-th International Congress on Mathematical Physics*, pages 373–381. World Sci. Publ., Hackensack, NJ, 2014.
- [11] Lars Andersson, Pieter Blue, and Jean-Philippe Nicolas. A decay estimate for a wave equation with trapping and a complex potential. *Int. Math. Res. Not. IMRN*, (3):548–561, 2013. arXiv:1107.4597.

- [12] P. Blue and A. Soffer. Phase space analysis on some black hole manifolds. *J. Funct. Anal.*, 256(1):1–90, 2009.
- [13] Pieter Blue. Decay of the Maxwell field on the Schwarzschild manifold. *J. Hyperbolic Differ. Equ.*, 5(4):807–856, 2008.
- [14] Pieter Blue and Avy Soffer. A space-time integral estimate for a large data semi-linear wave equation on the Schwarzschild manifold. *Lett. Math. Phys.*, 81(3):227–238, 2007.
- [15] P. Blue and J. Colliander. Global well-posedness in Sobolev space implies global existence for weighted L^2 initial data for L^2 -critical NLS. *Commun. Pure Appl. Anal.*, 5(4):691–708, 2006.
- [16] Pieter Blue and Avy Soffer. Errata for “global existence and scattering for the nonlinear schrodinger equation on Schwarzschild manifolds”, “semilinear wave equations on the Schwarzschild manifold i: Local decay estimates”, and “the wave equation on the Schwarzschild metric ii: Local decay for the spin 2 Regge Wheeler equation”. 2006. gr-qc/0608073.
- [17] Pieter Blue and Jacob Sterbenz. Uniform decay of local energy and the semi-linear wave equation on Schwarzschild space. *Comm. Math. Phys.*, 268(2):481–504, 2006.
- [18] P. Blue and A. Soffer. The wave equation on the Schwarzschild metric. II. Local decay for the spin-2 Regge-Wheeler equation. *J. Math. Phys.*, 46(1):012502, 9, 2005.
- [19] P. Blue and A. Soffer. Semilinear wave equations on the Schwarzschild manifold. I. Local decay estimates. *Adv. Differential Equations*, 8(5):595–614, 2003.

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